TRENCH EXCAVATION, BACKFILL & SURFACE RESTORATION SPECIFICATIONS
T100

Rochester, MN

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Section 1 GENERAL REQUIREMENTS

T100.101 Description

This work shall consist of the excavation, backfilling, and restoration of existing surface improvements for the purposes of installing new and/or relocating or adjusting existing underground utilities.

Use of the term "Plans, Specifications and Special Provisions" within this specification shall be construed to mean those documents, which compliment, modify, or clarify these specifications and are accepted as an enforceable component of the Contract or Contract Documents.

T100.102 Reference Documentation

All references to Mn/DOT Specifications shall mean the latest published edition of the Minnesota Department of Transportation Standard Specifications for Construction as modified by any Mn/DOT Supplemental Specifications issued before the date of advertisement for bids. All references to other Specifications of AASHTO, ASTM, ANSI, AWWA, etc. shall mean the latest published edition available on the date of advertisement for bids.

Section 2 MATERIALS

T100.201 Granular Materials

Granular materials furnished for foundation, bedding, encasement, backfill, or other purposes as may be specified shall consist of any natural or synthetic mineral aggregate such as sand, gravel, crushed rock, crushed stone, or slag, that shall be so graded as to meet the gradation requirements specified herein or as indicated in the Plans, Specifications, or Special Provisions.

T100.202 Granular Backfill

Granular backfill shall comply with Mn/DOT section 3149.2D except that in addition not more than 50% of the material shall pass the No. 40 sieve.

T100.203 Select Material for Backfill

Select Material for Backfill shall be sandy loam, sand, or gravel material approved by the City.

T100.204 Foundation Materials

Aggregate for pipe foundation shall comply with Mn/DOT Section 3137 CA-5.

T100.205 Fine Filter Aggregate

Fine filter aggregate shall comply with Mn/DOT Section 3149.2 J.

T100.206 Aggregate for Hydrant Drainage Pit

Aggregate for hydrant drainage pit shall comply with Mn/DOT Section 3137 CA-3.

T100.207 Bedding and Encasement

Bedding and encasement materials shall meet the requirements of Mn/DOT Section 3138 Class 5.

T100.208 Miscellaneous Material

Any other miscellaneous material required in the work, but which is not specifically mentioned in these specifications, shall be new, unused, undamaged, and of a quality equal to the materials specified herein and shall be submitted to, and approved by, the City prior to its use.

T100.209 Granular Material Use Designations

Granular Material Use Designations: Granular materials provided for Foundation, Bedding, Encasement, or Backfill use as required by the Plans, Specifications, and Special Provisions, either as part of the pipe item work unit or as a separate contract item, shall be classified as to use in accordance with the following:

Material Use Designation	Zone Designation
Granular Foundation	Placed below the bottom of pipe grade as replacement for unsuitable or unstable soils, to achieve better foundation support.
Granular Bedding	Placed from a point six-inches below the bottom of pipe to the midpoint, prior to pipe installation, to facilitate proper shaping and to achieve uniform pipe support.

Granular Encasement	Placed below an elevation one foot above the top of pipe, after pipe installation, for protection of the pipe and to assure proper filling of voids or thorough consolidation of backfill.
Granular Backfill	Placed above granular encasement to minimize trench settlement and provide support for surface improvements.

In each case above, unless otherwise indicated, the lower limits of any particular zone shall be the top surface of the next lower course as constructed. The upper limits of each zone are established to define variable needs for material gradation and compaction or void content, taking into consideration the sequence of construction and other conditions. The material use and zone designations described above shall only serve to fulfill the objectives and shall not be construed to restrict the use of any particular material in other zones where the gradation requirements are met.

T100.210 Piling

Piling shall be constructed in accordance with the provisions of Mn/DOT Specification 2452 and special plan details relating to piling.

T100.211 Insulation

Insulation shall be constructed in accordance with the provisions of Mn/DOT Specification 3760 and the City of Rochester Standard Plate.

T100.212 Geotextile Fabric

Geotextile fabric shall meet the requirements of Mn/DOT Specification 3733 and of the type as required by the Plans, Specifications, and Special Provisions.

T100.213 Casing

A. Steel Casing

Steel casing pipe shall be new material, with minimum yield strength of 35,000 psig (pounds per square inch gauge). All joints in steel casing pipe shall be welded. The following minimum wall thickness shall be used:

Casing Pipe Wall Thickness

Outside Diameter	Under Roadway
12” to 28”	0.250
30” to 34”	0.375
36” to 60”	0.500

B. Reinforced Concrete Casing

Reinforced concrete casing pipe must be properly classed based on the depth of cover over the pipe. A minimum of 5000 psi (pounds per square inch) concrete pipe must be used when casing pipe is jacked. Bell type ends are not permitted.

T100.214 High Density Polyethylene Pipe

High Density Polyethylene Pipe shall conform to AWWA Specification C906-90, or the latest revision thereof. All HDPE pipe shall be DR-11, and have a working pressure rating of 160 psi, or as otherwise specified on the plans.

All fittings to be used with HDPE pipe shall be typical cast iron or ductile iron mechanical joint fittings, adapters shall be used as necessary to connect to such fittings. Harvey connectors are approved for use with HDPE pipe for making connections to cast iron or ductile iron fittings. The cost of such adapters shall be considered subsidiary to the use of HDPE pipe and not be bid or paid for separately. HDPE fittings have not been approved for use on water projects.

Section 3 CONSTRUCTION REQUIREMENTS

T100.301 Maintenance of Traffic

Whenever work interferes with the flow of traffic along a roadway, the Contractor shall provide for traffic control and signing and public safety in accordance with the provisions of the field manual of Temporary Control Zone Layouts of the Minnesota Manual of Uniform Traffic Control Devices and Mn/DOT Specifications 1404 and 1710, and the Special Provisions. Neither road closures nor detours shall be permitted unless specified in the Special Provisions or authorized by the City. Where road closures or detours are permitted by the City, the City shall determine the appropriate agencies, boards, or departments the Contractor must notify prior to taking the action and the proper advance notice to be provided to each body.

Compliance with this requirement shall not be construed to relieve the Contractor from the responsibility of notifying agencies or institutions whose services may be predicated upon a roadway being opened to traffic or whose services would be hindered if a roadway is closed to traffic. Such agencies or institutions shall include, but not be limited to, the police department, the fire department, municipal bus service, school bus service, and ambulance service. The Contractor shall keep the required agencies informed of changing traffic patterns and detour situations.

T100.302 Establishing Line and Grade

The primary line and grade will be established by the Engineer. For trench installation, line and grade stakes will be set parallel to the proposed pipeline at an appropriate offset there from as will best serve the Contractor's operations wherever practical. For tunnel installation, line and grade stakes will be set directly above the proposed pipeline setting. Grade and line stakes will be set along the pipeline; at each change in line or grade; and as needed for pipeline appurtenances and service lines.

The Contractor shall arrange operations to avoid unnecessary interference with the establishment of the primary line and grade stakes; and shall render whatever assistance may be required by the Engineer in accomplishing the staking. The Contractor shall be responsible for preservation of the primary stakes and, if negligent in providing necessary protection, shall bear the full cost of any restaking.

No deviation shall be made from the required line or grade except with the consent of the City.

T100.303 Public Utilities

The Contractor shall be responsible to protect any existing utility from damage caused by or occurring during their operations. If the work requires excavation, the Contractor shall notify all utility owners by requesting on site utility locations using the state ‘Gopher One-call’ system. No existing public utility lines shall be disturbed by the operations of the Contractor, except those, which are specifically designated in the Special Provisions, without the express permission of the City. In case any of the aforementioned public utilities are broken or damaged in any way by the Contractor's operations, the owner of the utility shall be notified and damage repaired without delay. The cost of such repairs shall be paid by the Contractor or deducted from any estimates due him.

The locations of underground facilities shown on the plans are approximate only, and are shown only for the Contractor's general information. The city does not assume responsibility for showing all utilities on the plans. The Contractor shall use suitable precautions to prevent damage to pipes, conduits, and other underground or overhead structures.

T100.304 Protection of Surface Structures

All surface structures and features located outside the permissible excavation limits for underground installations, together with those within the construction areas, which are indicated in the Plans as being

saved, shall be properly protected against damage and shall not be disturbed or removed without approval of the City. Within the construction limits, as required, the removal of improvements such as paving, curbing, walks, turf, etc., shall be subject to acceptable replacement after completion of underground work, with all expense of removal and replacement being borne by the Contractor to the extent that separate compensation is not specifically provided for in the Contract.

Obstructions such as street signs, guard posts, small culverts, mailboxes, and other items of prefabricated construction may be temporarily removed during construction provided that essential service is maintained in a relocated setting as approved by the City and that nonessential items are properly stored for the duration of construction. Upon completion of the underground work, all such items shall be replaced in their proper setting at the sole expense of the Contractor.

In the event of damage to any surface improvements, either privately or publicly owned, in the absence of construction necessity, the Contractor will be required to replace or repair the damaged property to the satisfaction of the City and without cost to the Owner.

T100.305 Removal of Surface Improvements

Removal of surface improvements in connection with trench excavation shall be limited to actual needs for installation of the pipeline and appurtenances, based on the allowable trench widths and any other controls imposed in connection with the work. Removal operations shall be coordinated effectively with the excavation and installation operations as will cause the least practical disruption of traffic or inconvenience to the public. The debris resulting from removals shall become the property of the Contractor and shall be disposed of by the Contractor in accordance with Mn/DOT Specification 2104. Removal debris shall not be deposited at locations that will block access to fire hydrants, private driveways, or other essential service areas, nor obstruct surface drainage. Removal and final disposal of debris shall be accomplished as a single operation wherever possible and, in any event, the debris shall be removed from the site before starting the excavating operations.

Removal of concrete or bituminous structures shall be by methods producing clean-cut breakage to pre-scored lines as will preserve the remaining structure without damage. Removal equipment shall not be operated in a manner that will cause damage to the remaining structure or adjoining property. Where not removed to an existing joint, concrete structures shall be sawed along the break lines to a minimum depth of one-third of the structure depth.

Any reusable materials generated during the work, such as aggregate, sod, topsoil, shall be segregated from other waste materials and be stockpiled so as to maintain suitability and permit proper reuse.

The use of drop weight equipment for breaking pavement will be allowed to the extent that the Contractor shall assume full responsibility for any damages caused thereby. The pavement breaking operation shall not be allowed to become a nuisance to the public or a source of damage to underground or adjacent structures. The City reserves the right to order discontinuance of drop weight breaking operations at any time.

T100.306 Operational Limitations and Requirements

Excavating operations shall proceed only so far in advance of pipe laying as will satisfy the needs for coordination of work in a single day and permit advance verification of unobstructed line and grade as planned. Where interference with existing structures is possible or in any way indicated, and where necessary to establish elevation or direction for connections to inplace structures, the excavating shall be done at those locations in advance of the main operation so actual conditions will be exposed in sufficient time to make adjustments without resorting to extra work or unnecessary delay.

Where possible excavated materials shall be placed in areas that will not block existing vehicle, pedestrian traffic and drainage ways. The Contractor shall review proposed methods of operation with the City prior to beginning the work.

All installations shall be accomplished by open trench construction except for short tunnel sections approved by the City and with the exception that boring and jacking or tunnel construction methods shall be employed where so specifically required by the Plans, Specifications, or Special Provisions.

The excavating operations shall be conducted so as to carefully expose all inplace underground structures without damage. Wherever the excavation extends under or approaches so close to an existing structure as to endanger it in any way, precautions and protective measures shall be taken as necessary to preserve the structure and provide temporary support. Hand methods of excavating shall be utilized to probe for and expose such critical or hazardous installations as gas pipe and power or communication cables.

The City shall be notified of any need for blasting to remove materials, which cannot be broken up mechanically, and there shall be no blasting operations conducted until the City's approval has been secured. Blasting will be allowed only when proper precautions are taken to protect life and property, and then shall be restricted as the City directs. The hours of blasting operations shall be set by the City. The Contractor shall assume full responsibility for any damages caused by blasting, regardless of the requirements for notification and approval. The Contractor shall secure any required permits for blasting and shall conduct blasting operations in conformance with all applicable local, state and federal laws, regulations, and ordinances.

T100.307 Excavation Limitations and Requirements

Trench excavating shall be to a depth that will permit preparation of the foundation as specified and installation of the pipeline and appurtenances at the prescribed line and grade, except where alterations are specifically authorized. Trench widths shall be sufficient to permit the pipe to be laid and joined properly and the backfill to be placed and compacted as specified. Extra width shall be provided as necessary to permit convenient placement of sheeting and shoring and to accommodate placement of appurtenances.

Excavations shall be extended below the bottom of structure, as necessary to accommodate any required Granular Foundation material. When rock or unstable foundation materials are encountered at the established grade, additional materials shall be removed as specified or ordered by the City to produce an acceptable foundation. Unless otherwise indicated or directed, rock shall be removed to an elevation at least six-inches below the bottom surface of the pipe barrel and below the lowest projection of joint hubs. All excavations below grade shall be to a minimum width equal to the outside pipe diameter plus two feet. Rock shall be removed to such additional horizontal dimensions as will provide a minimum clearance of six-inches on all sides of appurtenant structures such as valves, housings, access structures, etc.

Where no other grade controls are indicated or established for the pipeline, the excavating and foundation preparations shall be such as to provide a minimum cover over the top of the pipe as specified. Trench widths shall allow for at least six-inches of clearance on each side of the joint hubs. The maximum allowable width of the trench at the top of pipe level shall be the outside diameter of the pipe plus two feet, subject to the considerations for alternate pipe loading set forth below. The width of the trench at the ground surface shall be held to a minimum to prevent unnecessary destruction of the surface structures.

The maximum allowable trench width at the level of the top of pipe may be exceeded only by approval of the City, after consideration of pipe strength and loading relationships. Any alternate proposals made by the Contractor shall be in writing, giving the pertinent soil weight data and proposed pipe strength alternate, at least seven days prior to the desired date of decision. Approval of alternate pipe designs shall

be with the understanding that there will be no extra compensation allowed for any increase in material or construction costs.

T100.308 Preparation and Maintenance of Foundations

Foundation preparations shall be conducted as necessary to produce a stable, dry foundation and provide continuous and uniform pipe bearing between bell holes. The initial excavating or backfilling operations shall produce a subgrade level slightly above finished grade as will permit hand shaping to finished grade by trimming of high spots and without the need for filling of low spots to grade.

Whenever ground water or surface water is encountered, the Contractor shall provide suitable means for the removal of the same and in no case shall this water be allowed to flow into the sewer pipe (Sanitary Sewer or Storm Sewer) except with the permission of the City.

When quicksand or other unsatisfactory foundation soils are encountered, the Contractor shall immediately notify the City. Upon receiving such notice, and after an inspection has been made, the City may direct the work to proceed in accordance with Mn/DOT section 1403 Extra Work.

T100.309 Sheeting and Bracing Excavations

All excavations shall be sheeted, shored, and braced as will meet all requirements of the applicable safety codes and regulations; comply with any specific requirements of the Contract; and prevent disturbance or settlement of adjacent surfaces, foundations, structures, utilities, and other properties. Any damage to the work or to adjacent structures caused by settlement, water or earth pressures, or other causes due to failure or lack of sheeting, shoring, or bracing or through negligence or fault of the Contractor in any manner, shall be repaired at the Contractor's expense and without delay.

The Contractor shall assume full responsibility for proper and adequate placement of sheeting, shoring, and bracing wherever and to such depths that soil stability may dictate the need for support to prevent displacement. Bracing shall be so arranged as to provide ample working space and so as not to place stress or strain on the inplace structures to any extent that may cause damage.

Sheeting, shoring and bracing materials shall be removed only when and in such manner as will assure adequate protection of the inplace structures and prevent displacement of supported grounds. Sheeting and bracing shall be left in place only as required by the Plans, Specifications, and Special Provisions or ordered by the City. Otherwise, sheeting and bracing may be removed as the backfilling reaches the level of respective support. Wherever sheeting and bracing is left in place, the upper portions shall be cut and removed to an elevation of three feet or more below the established surface grade as the City may direct.

In the absence of special payment provisions, all costs of furnishing, placing and removing sheeting, shoring, and bracing materials, including the value of materials left in place as required by the Contract, shall be included in the prices bid for pipe installation and will not be compensated for separately.

T100.310 Jacking/Boring

The terms "auger", "boring", "jack", "jacking", and "tunneling" in the proposal, specifications, and plans refers only to non-open cut construction. The Contractor shall inspect and verify soil conditions, in order to determine the type of construction to employ. During the construction, the Contractor shall be responsible for protecting all existing utilities above the pipe invert.

The following methods are allowed for installing the main within the casing:

The pipe will be mounted on pressure-treated wooden skids, restricting the pipe from both lateral and vertical movement, supporting the pipe along the barrel rather than at the joints. The space between the pipe and casing shall be backfilled with dried sand blown into place, and the ends of

the casing shall be sealed with concrete bulkheads at least one foot thick. A 2-inch PVC, copper or ductile iron drain shall be provided through the bulkhead at the lower end of the casing.
OR
RACI, or approved equivalent, casing spacers shall be used to install carrier pipe inside the casing pipe according to the manufacturer's instructions. The ends of the casing shall be sealed using a wrap around end seal made of 1/8" thickness rubber and 2 stainless steel bands.

For watermain installation, the casing pipe diameter shall be as shown on the Plans. For other than watermain installation, the minimum diameter of the casing pipe shall be four (4)-inches greater than the outside diameter of the bell of the carrier pipe.

Casing pipe shall be installed using equipment that encases the hole as the earth is removed. The machine used shall be capable of controlling line and grade. Boring without the concurrent installation of a casing pipe will not be permitted. Casing pipe shall extend through the entire fill and be installed in a manner that will not disrupt traffic or damage roadway grade and surface. For any installation beneath a railroad, the top of the casing pipe shall not be closer than the specified dimensions indicated in the permit.

Casing pipe installations will be rejected if the alignment, grade or elevations do not allow for installation of the sewer main according to the plans. Rejected casing pipes shall be filled with sand and capped by the contractor in a manner approved by the Engineer at no cost to the Owner. A new casing pipe shall be furnished and installed by the Contractor to replace the rejected casing pipe. The new casing pipe shall be installed at a location approved by the Engineer.

No jacking/auguring of pipe will be allowed below the water table unless the water table has been lowered sufficiently to keep the water below the pipe being installed. The use of water under pressure (jetting) or puddling will not be permitted to facilitate jacking auguring operations.

If any installation is augured, the auger shall lead the casing or carrier pipe by no more than six (6) inches. All voids caused by jacking or boring shall be filled by pressure grouting or bentonite. The grout material shall consist of sand-cement slurry of at least two sacks of cement per cubic yard and a minimum of water to assure satisfactory placement. A 1-1/2 inch pipe shall be forced along the top of the casing pipe. The front end of this pipe shall be 18 inches behind the front end of the casing pipe. A mixture of water and bentonite clay shall be forced through this pipe at all times during the casing installation to fill any voids that may be present above the casing pipe. Upon completion of the casing installation, this pipe shall be slowly withdrawn while bentonite is forced through the pipe to fill any remaining voids.

T100.311 Directional Boring

Directional boring/drilling installation shall be accomplished where required on the Plans or in the Special Provisions to minimize disturbance of existing surface improvements. The installer shall have a minimum of three years of experience in this method of construction and have installed at least 1,000 feet of 8-inch or larger diameter pipe to specified grades. The field supervisor employed by the Contractor shall have at least three years of experience and shall be at the site at all times during the boring/drilling installation, and be responsible for all of the work.

The Contractor shall submit boring/drilling pit locations to the City before beginning construction.

The drilling equipment shall be capable of placing the pipe as shown on the plans. The installation shall be by a steerable drilling tool capable of installing continuous runs of pipe without intermediate pits, a minimum distance of 200 feet. The guidance system shall be capable of installing pipe within 1-1/2-inch of the plan vertical dimensions and 2-inches of the plan horizontal dimensions. The Contractor shall be required to remove and reinstall pipes, which vary in depth and alignment from these tolerances.

Pull back forces shall not exceed the allowable pulling forces for the pipe being installed. Drilling fluid shall be a mixture of water and bentonite clay. Disposal of excess fluid and spoils shall be the responsibility of the Contractor.

T100.312 Trenchless Watermain (High Density Polyethylene Pipe)

All High Density Polyethylene Pipe (HDPE) pipe shall be joined using butt fusion. The Contractor shall provide the appropriate butt fusion equipment to join the pipe. Joints shall conform to the manufacturers recommendations and be water tight at the test pressure. The bead which forms during the fusion process shall be uniform, indicating a proper fusion. Joints not meeting these requirements shall be cut out and remade. Joint fusion shall be incidental to the pipe installation.

T100.313 Placement of Insulation

Rigid insulation board shall be placed within the pipe encasement zone, 6-inches above the pipe. Prior to placement of the insulation, encasement material shall be leveled and compacted until there is no further visual evidence of increased consolidation or the density of the compacted layer conforms to the density requirements specified in the Special Provisions, then leveled and lightly scarified to a depth of 1/2-inch. Encasement zone material placed below the insulation shall be free of rock or stone fragments measuring 1-1/2-inches or greater.

Insulation boards shall be placed on the scarified material according to the Detail Plate. Boards shall be placed in a single layer with tight joints. No continuous joints or seams shall be placed directly over the pipe. If two or more layers of insulation boards are used, each layer shall be placed to cover the joints of the layer immediately below.

The Contractor shall exercise precaution to insure that all joints between boards are tight during placement and backfilling with only extruded ends placed end-to-end or edge-to-edge.

The first layer of material placed over the insulation shall be 6-inches in depth, free of rock or stone fragments measuring 1-1/2 inches or greater. The material shall be placed in such a manner that construction equipment does not operate directly on the insulation and shall be compacted with equipment, which exerts a contact pressure of less than 80 psi.

T100.314 Pipeline Backfilling Operations

All pipeline excavations shall be backfilled to restore preexisting conditions as the minimum requirement, and fulfill all supplementary requirements indicated in the Plans, Specifications, and Special Provisions. The backfilling operations shall be started as soon as conditions will permit on each section of pipeline, so as to provide continuity in subsequent operations and restore normal public service as soon as practicable on a section-by-section basis. All operations shall be pursued diligently, with proper and adequate equipment, as will assure acceptable results.

The backfilling shall be accomplished with the use of Suitable Materials selected from the excavated materials to the extent available and practical. Should the materials available within the trench section be unsuitable or insufficient, without loading and hauling or the employment of unreasonable measures, the required additional materials shall be furnished from outside sources as an Extra Work item in the absence of any Special Provision requirements.

Suitable Material shall be defined as a mineral soil free of foreign materials (rubbish, debris, etc.), frozen clumps, oversize stone, rock, concrete or bituminous chunks, and other unsuitable materials, that may damage the pipe installation, prevent thorough compaction, or increase the risks of after settlement unnecessarily. Material selection shall be such as to make the best and fullest utilization of what is available; taking into consideration particular needs of different backfill zones. Material containing stone,

rock, or chunks of any sort shall only be utilized where and to the extent there will be no detrimental effects, such as outside the road section.

Within the pipe bedding and encasement zones described as that portion of the trench which is below an elevation one foot above the top of the pipe, the materials placed shall be limited in particle size to 1 – 1/2-inches maximum in the case of pipe of 12-inches in diameter or less and to 2-inches maximum in the case of larger pipe. Above these zones, the placement of material containing stones, boulders, chunks, etc. greater than 8-inches in any dimension shall not be allowed in the road section.

All flexible pipes shall be bedded in accordance with ASTM Specification D2321, "Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe". This shall include placement of granular bedding and encasement materials from a point six-inches below the bottom of pipe to a point twelve-inches above the top of the pipe. Placement and compaction of bedding and encasement materials around the pipe shall be considered incidental to the installation of the pipe. Where existing soils do not meet the requirements of bedding and encasement materials the Contractor shall furnish the required granular materials.

All surplus or waste materials remaining after completion of the backfilling operations shall be disposed of in an acceptable manner within 24 hours after completing the backfill work on each particular pipeline section. Disposal at any location within the project limits shall be as specified, or as approved by the City; otherwise, disposal shall be accomplished outside the project limits at the Contractor's discretion. The backfilling and surplus or waste disposal operations shall be a part of the work required under the pipeline installation items, not as work that may be delayed until final cleanup.

T100.315 Compaction of Materials

Compaction of materials placed within the pipe bedding and encasement zones shall be accomplished with portable or hand equipment methods, so as to achieve thorough consolidation under and around the pipe and avoid damage to the pipe. Above the cover zone material, the use of heavy roller type compaction equipment shall be limited to safe pipe loading.

Backfill materials shall be carefully placed in uniform loose thickness layers up to 12-inches thick spread over the full width and length of the trench section to provide simultaneous support on both sides of the pipeline. Backfill may be placed in 12-inch layers above an elevation one-foot above the top of the pipe.

Compaction of backfill within Roadbed areas shall meet the density requirements of Mn/DOT Specification 2105.
Compaction of backfill in all other areas shall be compacted effectively, by approved mechanical or hand methods, until there is no further visual evidence of increased consolidation.

Until expiration of the warranty period, the Contractor shall assume full responsibility and expense for all backfill settlement and shall refill and restore the work as directed to maintain an acceptable surface condition, regardless of location. All additional materials required shall be furnished without additional cost to the City.

Any pronounced settlement of road surfaces that are either placed under this Contract or by others under either public or private contract and that are within the guarantee period shall be considered failure of the mechanical compaction. The Contractor shall be required to repair such settlement including all items placed by others.

T100.316 Restoration of Surface Improvements

Wherever any surface improvements such as pavement, curbing, pedestrian walks, fencing, or turf have been removed, damaged or otherwise disturbed by the Contractor's operations, they shall be repaired or replaced to the City's satisfaction, as will restore the improvement in kind and structure to the preexisting

condition. Each item of restoration work shall be done as soon as practicable after completion of installation and backfilling operations on each section of pipeline.

In the absence of specific payment provisions, as separate Contract Items, the restoration work shall be compensated for as part of the work required under those Contract Items, which necessitated the destruction and replacement or repair, and there will be no separate payment therefore. If separate pay items are provided for restoration work, only that portion of the repair or reconstruction which was necessitated by the Contract work will be measured for payment. Any improvements removed or damaged unnecessarily or undermined shall be replaced or repaired at the Contractor's expense.

T100.317 Turf Restoration

Turf restoration shall be accomplished by sod placement except where seeding is specifically allowed or required.

Topsoil shall be placed to a minimum depth of three-inches under all sod and 6-inches in all areas seeded. The topsoil material used shall be light friable loam containing a liberal amount of humus and shall be free of heavy clay, coarse sand, stones, plants, roots, sticks and other foreign matter. Topsoil meeting these requirements shall be selected from the excavated materials to the extent available and needed.

All turf establishment work shall be done in substantial compliance with the provisions of Mn/DOT Specification 2575 using seed mixtures as specified in the Special Provisions or Proposal.

T100.318 Pavement Restoration

The inplace pavement structure (including base aggregates) shall be restored in kind and depth as previously existed, using base aggregates salvaged from the excavated materials to the extent available and needed, and with new materials being provided for reconstruction of the concrete or bituminous surface courses.

The minimum thickness of the bituminous portion of the restoration shall be 4-inches, but in no case shall the thickness be less than the abutting pavement. The minimum compacted thickness of the aggregate base in the trenched area shall be 6-inches, but in no case less than the existing aggregate base.

Reconstruction of aggregate base courses and concrete or bituminous surface courses shall be in substantial compliance with all applicable Mn/DOT Specifications pertaining to the item being restored. The materials used shall be comparable to those used in the inplace structure, and the workmanship and finished quality shall be equal to that of new construction to the fullest extent obtainable in consideration of operational restrictions.

Existing concrete and bituminous surfaces at the trench wall shall be sawed or cut with a cutting wheel to form a neat edge in a straight line before surfaces are to be restored. Sawing or cutting may be accomplished as a part of the removal or prior to restoration at the option of the Contractor. However, all surface edges will be inspected prior to restoration.

T100.319 Restoration of Miscellaneous Items

Wherever any curbing, curb and gutter sections, pedestrian walks, fencing, driveway surfacing, or other improvements are removed or in any way damaged or undermined, they shall be restored to original condition by repair or replacement as the City considers necessary. Replacement of old materials will be acceptable only to the extent that existing quality can be fully achieved such as in the case of fencing. Otherwise new materials shall be provided and placed as the City directs. Workmanship and finished quality shall be equal to that of new construction, where new materials are used, to the extent obtainable in consideration of operational restrictions. No direct compensation will be made for furnishing and placing this material even though such course was not part of the original construction.

T100.320 Final Cleanup

All subgrade surfaces shall be maintained acceptably until the start of surfacing construction or restoration work and until the work has been finally accepted. Additional materials shall be provided and placed as needed to compensate for trench settlement and to serve as temporary construction pending completion of the final surface improvements.

Final disposal of debris, waste materials and other remains or consequences of construction shall be accomplished intermittently as new construction items are completed and shall not be left to await final completion of all work. Cleanup operations shall be considered as being a part of the work covered under the Contract Items involved and only that work which cannot be accomplished at any early time shall be considered as final cleanup work not attributable to a specific Contract Item.

If disposal operations and other cleanup work are not conducted properly as the construction progresses, the City may withhold partial payments until such work is satisfactorily pursued or he may deduct the estimated cost of its performance from the partial estimate value.

Maintenance of sodded and seeded areas shall include adequate watering for plant growth and the replacement of any dead or damaged sod as may be required for acceptance of the work.

T100.321 Maintenance and Repair

The Contractor shall guarantee all work relating to the Specifications for a period of (2) years from the date of acceptance of the work or project. The Contractor shall make all needed repairs arising out of defective workmanship or materials, which in the judgment of the City shall become necessary during such period. If within ten days after the mailing of a notice in writing to the Contractor, the said Contractor shall neglect to undertake, the aforesaid repairs, the City is hereby authorized to make such repairs. The Contractor shall reimburse the City for the costs of such repairs or the City may require reimbursement therefore from the surety of the Contract Bond.

Section 4 METHOD OF MEASUREMENT

T100.401 Description

All items will be measured separately according to design designation as indicated in the Pay Item name and as may be detailed and defined in the Plans, Specifications, or Special Provisions. Complete-in-Place items shall include all component parts thereof as described or required to complete the unit, but excluding any excesses covered by separate Pay Items.

T100.402 Trench Excavation

A. Trench Depth Increments

Trench excavation will be measured in linear feet of trench, according to the depth zone classification specified as follows:

From 0 to 8 feet
From 8 to 10 feet
From 10 to 12 feet
From 12 to 14 feet
From 14 to 16 feet
From 16 to 18 feet

Linear measurement for trench excavation will be made along the centerline of the trench to the nearest foot from center to center of manholes, catch basins, or junctions.

B. Trench Depth Measurement

The depth of trench shall be measured according to the following provisions:

In those areas where the lowering of the existing ground profile is required as part of the same project, the depth of the trench shall be from the established subgrade profile at the centerline of the trench to the established sewer invert grade.

In those areas where no lowering of the existing ground profile is required as part of the same project, the depth of the trench shall be that distance from the existing ground line to the established sewer invert grade.

T100.403 Rock Excavation

Rock Excavation shall be measured by volume in cubic yards. Depth shall be measured from the top of the rock to a point six-inches below the outside barrel of the Pipe and width shall be the outside diameter of the pipe plus twenty-four-inches (12" from each side). The minimum width of measurement shall be three feet.

T100.404 Granular Materials

Granular materials furnished and placed as special foundation, bedding, encasement, or backfill construction will be measured by weight or volume of material furnished by the Contractor from outside sources and placed within the limits defined. Unless otherwise specified, volume will be determined by vehicular measure (loose volume) at the point of delivery. Measurements will not include any materials required to be placed as a component part of other Contract Items as may be specified.

T100.405 Piling

Piling shall be measured according to the provisions of Mn/DOT Specification 2452.

Pile bents shall be measured as a unit and shall include all materials and labor required, except the pile.

T100.406 Sheeting

Sheeting shall be measured on a square foot basis. Sheeting ordered left in place will be measured and paid for by the square foot of the overall area of the front face of the sheeting including the cut-off sections, if any.

T100.407 Insulation

Rigid board insulation shall be measured on a square foot basis installed to the specified thickness noted on the Plans, Detail Plates, or Special Provisions and shall include all materials, equipment, and labor required for placement.

T100.408 Geotextile Fabric

Where geotextile fabric is used for improving pipe foundation it shall be measured by the square foot of material installed.

T100.409 TrenchlessWatermain

Trenchless Watermain of each kind and size will be measured separately to the nearest foot, by the overall length along the axis of the pipeline, from beginning to end of each installation and without regard to intervening valves or specials. Terminal points of measure will be the spigot or cut end, base of hub or bell end, center of valves or hydrants, intersecting centers of tee or wye branch service connections, and center of corporation stop or curb stop couplings.

T100.410 Furnish &Install Steel Carrier Casing (Open-cut)

Steel Casing will be measured by linear foot along the line of casing.

T100.411 Furnish &Install Steel Carrier Casing (Jack & Auger)

Steel Casing will be measured by linear foot along the line of casing.

Section 5 BASIS OF PAYMENT

T100.501 Description

All costs of excavating to foundation grade, preparing the foundation, placing and compacting backfill materials, restoring surface improvements, and other work necessary for prosecution and completion of the work as specified, shall be included for payment as part of the pipe and pipe appurtenance items without any direct compensation being made.

Granular materials furnished for foundation, bedding, encasement, or backfill placement as specified in connection with pipe or structure items will only be paid for as separate Contract Items to the extent that the Proposal contains specific Pay Items. Otherwise the furnishing and placing of granular materials as specified shall be incidental to the pipe or structure item without any direct compensation being made.

In the absence of special payment provisions, all costs of restoring surface improvements as required, disposal of surplus or waste materials, maintenance and repair of completed work, and final cleanup operations shall be incidental to the Contract Items under which the costs are incurred.

T100.502 Items List

Payment for construction of Trenching will be made on the basis of the following schedule:

ITEM NO	ITEM	UNIT
SEWER		
S100.501	TRENCH EXCAVATION FOR PIPE 24IN & UNDER __FT TO __FT DEEP	LIN FT
S100.502	TRENCH EXCAVATION FOR PIPE OVER 24IN __FT TO __FT DEEP	LIN FT
S100.503	TRENCH EXCAVATION COMMON TRENCH __FT TO __FT DEEP	LIN FT
S100.505	WORK SHAFT "__"	EACH
S100.506	TRENCH DEWATERING	LIN FT
S100.507	SOLID ROCK EXCAVATION	CU YD
S100.508	SHEETING LEFT INPLACE	SQ FT
S100.509	SELECT MATERIAL FOR BACKFILL (__)	CU YD
S100.510	GRANULAR MATERIAL FOR BACKFILL (__)	CU YD
S100.511	AGGREGATE FOR PIPE FOUNDATION GRADATION __ (__)	CU YD
S100.512	FILTER MATERIAL (__)	CU YD
S100.513	FURNISH & INSTALL CONCRETE INSULATION	CU YD
S100.513	FURNISH & INSTALL CONCRETE INSULATION	LIN FT
S100.514	FURNISH & INSTALL __IN POLYSTYRENE INSULATION	SQ FT
S100.515	CONCRETE ENCASEMENT	CU YD
S100.515	CONCRETE CRADLE	EACH
S100.515	CONCRETE CRADLE	CU YD
S100.538	JACK & AUGER __IN CASING	LIN FT
WATER		
W200.501	TRENCH EXCAVATION FOR PIPE __IN & UNDER	LIN FT
W200.502	TRENCH EXCAVATION FOR PIPE OVER __IN	LIN FT
W200.506	TRENCH DEWATERING	LIN FT
W200.507	SOLID ROCK EXCAVATION	CU YD
W200.508	SHEETING LEFT INPLACE	SQ FT
W200.509	SELECT MATERIAL FOR BACKFILL (__)	CU YD
W200.510	GRANULAR MATERIAL FOR BACKFILL (__)	CU YD
W200.511	AGGREGATE FOR PIPE FOUNDATION GRADATION __ (__)	CU YD
W200.514	FURNISH & INSTALL __IN POLYSTYRENE INSULATION	SQ FT
W200.515	FURNISH & INSTALL POLYETHYLENE ENCASEMENT FOR __IN DUCTILE IRON PIPE	LIN FT
W200.528	FURNISH & INSTALL __IN DUCTILE IRON PIPE CLASS 52	LIN FT
W200.530	FURNISH & INSTALL __IN TYPE K COPPER WATER PIPE	LIN FT
W200.535	FURNISH & INSTALL __IN CASING	LIN FT
W200.538	JACK & AUGER __IN CASING	LIN FT